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RESEARCH ARTICLE

Results of a Controlled Study in Lifestyle Medicine Focused on Nutrition, Physical Activity and Stress Management in a Cohort of Preclinical Medical Students

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ABSTRACT

Background: Health behaviors such as poor diet, substance use, and inactivity increase the risk of developing chronic disease. Lifestyle Medicine is an emerging field that enables providers to educate and counsel patients on improving these health behaviors. Many physicians, however, are not adequately trained in lifestyle medicine; therefore, incorporating lifestyle medicine into medical education is recommended. Studies investigating the effects of incorporating lifestyle medicine education in medical school, however, are sparse.

Aims: This paper reports on a controlled study to test the effects of a lifestyle medicine education elective within the medical school curriculum.

Methods: The study was approved by the Institutional Review Board. Fifty-eight preclinical students gave informed consent. Students completed screening instruments assessing physical activity, consumption of fats and fruits/vegetables, anxiety, perceived distress, and mood. First-year students were assigned to the control group and reassessed after three months. Second-year students chose one of three focus groups (nutrition, stress management or physical activity), that met for approximately 3 hours, and set a personal goal for change. At the end of the intervention, they were reassessed. The controls had the opportunity to participate in the same focus groups for the same amount of time. Statistical analysis comprised analysis of covariance and paired t-tests.

Results: Intervention students performed better than the controls in reducing perceived stress, anxiety, and dietary fat. Paired t-tests comparing baseline and post intervention in all subjects who had the intervention revealed significant improvements in perceived stress, anxiety, mood, dietary fat, fruits and vegetables consumption and number of minutes of physical activity. Analysis of the focus groups pre and post measures showed significant improvements in anxiety and perceived stress in the stress management groups, improvements in both measures of nutrition in the nutrition group, but no significant changes in physical activity in physical activity group.

Conclusion: It is feasible to add lifestyle medicine concepts and techniques to the medical school curriculum. Medical students significantly improved multiple lifestyle medicine behaviors after being part of the elective. They also experienced the process of setting specific, measurable, achievable, relevant, and timely goals and implementing a plan for change, which can be useful in their future practice.

Introduction

Worldwide, noncommunicable diseases (NCD) account for 74% of all deaths and are the leading drivers of healthcare costs.[1-2] Health behaviors such as poor diet, tobacco use, sedentary lifestyle, and alcohol use greatly increase the risk of developing NCDs. An important way to decrease NCDs is to reduce these modifiable risk factors that are linked to these diseases.[1-2] Moreover, recognizing the interaction of mental health and chronic disease and focusing on prevention can aid in the prevention, reversal and management of NCDs. [3]

Physicians have been encouraged to be part of the solution, addressing the root cause of chronic disease, and incorporating lifestyle medicine (LM) into their daily practice.[4] LM is defined as a "medical specialty that uses therapeutic lifestyle interventions as a primary modality to treat chronic conditions including, but not limited to, cardiovascular diseases, type 2 diabetes, and obesity. LM certified clinicians are trained to apply evidence-based, whole-person, prescriptive lifestyle change to treat and, when used intensively, often reverse such conditions".[5] Competencies have been published to guide physicians in the practice of LM and encouraging advocacy and leadership related to LM.[6-7]

As the LM specialty gains traction and evolves, it is emerging as an important component of medical education.[8-11] Some programs have focused on only one aspect of lifestyle, such as nutrition[12]or stress management,[13]other programs have included more than one area of lifestyle change simultaneously.[14-16] Overall, however, there is a paucity of literature on the effects of incorporating LM into medical curricula.

Yammaha and colleagues[12]created an intervention for medical students aimed not only at improving the students' nutrition habits but also improving their nutrition care competencies. They reported that both students' diet and activity levels improved significantly. Students reported increased self-efficacy in their ability to include nutritional elements in their future work with patients. The work of Kakoschke and associates[13] focused on medical student psychological well-being. Their program provided a mindfulness-based intervention with the goal of reducing stress. They found that the intervention produced a significant decrease in perceived stress scores. Research conducted by McGrady, Badenhop, and Lynch[14] introduced medical students to lifestyle medicine by providing them the opportunity to participate in groups focused on one of three areas: nutrition, activity, or stress management. The authors explored the impact that participation in this lifestyle medicine elective had on medical students' health behaviors. Pre- and post-test data from this study demonstrated an improvement in the medical students' self-reported nutrition, depression, and anxiety. Medical students evaluated the elective positively and reported an increased understanding of how lifestyle medicine concepts could be useful in-patient care.

Another study on this topic was completed by McGrady, Brennan, Riese, Dowling, and Lynch .[15] Results further demonstrated the value of LM in medical student education curriculum. Three month follow up data collection showed that the medical students' scores remained improved compared to immediate post intervention, indicating maintenance of positive health behavior changes.

A recent review of articles discussing educational practices related to lifestyle medicine found that most LM curricula was geared towards medical students (75%), within their preclinical years (55%).[17] The teaching focused on nutrition (78%) and exercise (59%) as methods to prevent and manage disease, had an average of 13.7 curriculum hours, and were typically presented in a lecture format (53%). Researchers also found that only 44% of the studies examined included the lifestyle medicine competencies, specifically, personal experience with change.

There are only a few controlled studies regarding the impact of lifestyle medicine curricula on medical student well-being and health behavior. This paper reports on a controlled study to test the effects of a lifestyle medicine education elective within medical school curriculum. The curriculum included lectures, case discussion, and a person journey of change in one of multiple focus areas. Beyond personal benefits, we sought to provide future physicians with the tools to better treat patients impacted by chronic diseases and improve overall health behaviors.

Methods

First and second year students at a medium-sized, midwestern medical school were informed through the academic website about a one-semester Lifestyle Medicine elective. Participating students signed up at the beginning of the semester and received credit after completion of course requirements.

The study was approved by the Institutional Review Board (IRB), and all participants were offered the

consent form to sign, but this was not necessary for the students to receive credit.

POPULATION

Approximately 175 students were eligible each year the elective was offered in person (2019), (2021) (2022). Fifty-eight students gave informed consent. Four dropped out after the baseline sessions (one in 2019 and 3 in 2022). There were missing data among the students who completed the elective. Twenty students completed the elective in 2019, 28 in 2021 and 6 in 2022. In 2020 the elective was offered remotely; data from those students are not included in this analysis.

PROCEDURES

At the first session, the faculty explained the schedule and requirements to receive credit. This was followed by a general lecture on the prevalence of chronic illnesses in the general population and the relationship of the major lifestyle factors on development of todays' major illnesses. Then, the effects of lifestyle on personal mental and physical well-being of medical students were emphasized. Students completed screening instruments which assessed physical activity, consumption of fats and fruits/vegetables, anxiety, perceived distress, and mood; these are described below in the Measures section.

During the second group session, students received their scores on the screeners. If they did not sign the consent form, they received their data, but their information is not included in the analysis. The faculty provided interpretation of the scores, including normal ranges. It was emphasized that the focus groups were not support groups nor were they designed to substitute for mental health services. At this point, the first-year students were told they were in the control group, and they left the room. The second-year students chose the focus group in which they wanted to participate. Facilitators guided the students through a goal setting exercise utilizing the specific, measurable, achievable, relevant, and timely (SMART) goal framework for their specific area. A SMART goal is characterized by these attributes: specific, measurable, achievable, realistic, and time-based.[18]

During the following 6-8 weeks, students met with the focus group leaders who were experts in their field at least three times. Sixteen students chose physical activity; 21 students chose stress management, and 14 students chose nutrition. No students chose physical activity during the 2022-2023 academic year.

In the stress management group, students attended three 45-min sessions, directed for the most part to decreasing anxiety and perceptions of stress.[19] Topics included identifying current major stressors in medical school and recognizing maladaptive reactions, for example catastrophic thinking. When students highlighted the effects of anxiety and worry on sleep patterns, a portion of one session was allocated to changing thought patterns associated with insomnia. Skill building consisted of slow breathing, progressive relaxation, mindfulness, and basic cognitive restructuring. Regular daily practice using phone apps or written materials was recommended, but not formally tracked.

Students in the nutrition group met with a registered and licensed dietician at least 3 times. A more detailed analysis of daily consumption of healthy and unhealthy foods was conducted based on the best evidence of elements of a healthy diet pattern.[20] The students created a specific nutrition goal based on the analysis completed. Examples of goals included decreasing high saturated fat foods, learning how to eat mindfully, and increasing consumption of fruits and vegetables without a significant increase in food costs. Emphasis was placed on practical strategies to achieve their goals; behavior change skills and the use of technology to assist them in maintaining accountability.

If students chose to focus on improving their physical activity, they met 3-4 times during the semester as a group. Group leaders helped students problem solve ways to include more activity into already busy days with tips such as having walking meetings when possible, keeping gym clothes/shoes in their car so always available, having accountability partners, and rewarding oneself for reaching activity goals. Students shared their challenges with increasing activity especially during exams and study time, and problem-solved ways to add increased activity incrementally during the day. Group leaders stressed the importance of taking at least brief study breaks to help with focus, and ways to insert at least some activity.

After the 8 weeks allocated to the focus group meetings, students attended two additional group sessions. Students discussed patient cases which highlighted the effects of unhealthy lifestyle on physical and emotional health; then students designed theoretical treatment plans for the patients. Students completed the same assessments as they did at baseline and received a summary of their second set of scores. They also completed an evaluation for the elective. Three months after the end of the elective for the students completing it in

the fall, students were contacted and asked to complete the same assessments again. There was no contact between faculty and students between the end of the elective and the follow up data collection point. All follow up data collection was done remotely.

The students assigned to the control group (first year medical students) returned to complete the assessments again. These students were offered the exact same choice of focus groups, set SMART goals and received the same nutrition, stress management or physical activity instructions from the same faculty. All students completed the requirements of the elective and received credit.

MEASURES

Students were encouraged to track activity using smart phones and watches, which typically come standard with pedometers and other methods of measuring activity. In addition, recording the number of steps, minutes of activity, and types of activity helped to hold students accountable and track progress. Steps per day was the variable used in the analysis. Nutrition was assessed by screeners for fruits/vegetables, and fat consumption.[21] These consisted of lists of fruits and vegetables and fat containing foods consumed on a daily, weekly or less frequent basis. A score was generated based on consumption per week of fruits/vegetables and the percentage of saturated fats in the diet. Those scores indicated whether students were consuming too few fruits/vegetables and/or too high fat. For example, if the fruits/vegetables screener generated a score of less than 10, that student's consumption of those foods was 1-2 per day, whereas if the score was 16 or more, that student was consuming 5 fruits/vegetables per day. Regarding fats, if the screener generated a score of less than 7, that student was consuming less than 25% fat in their diet, whereas if their score was higher than 23, they may be consuming greater than 40% fat in their diet.

Distress was indexed by measures of anxiety, depression, and perceived stress. Anxiety was assessed by the Generalized Anxiety Disorder Scale (GAD-7).[22] This self-report screener is composed of seven items on which subjects record the frequency of anxiety symptoms over the previous two weeks. Scores range from 0-21. Scores of five, ten, and 15 are taken as the cut-off points for mild, moderate, and severe anxiety, respectively. Using the threshold score of ten, it has a sensitivity of 89% and a specificity of 82% for the diagnosis of Generalized Anxiety Disorder. Depression was assessed by the Patient Health Questionnaire-9 (PHQ-9).[23] This screener has nine items and subjects rate the frequency of depressed symptoms over the previous two weeks. Scores can range from 0-27. Scores of five, ten, 15 and 20 are taken as the cut off points for mild, moderate, moderately severe, and severe depression. Using ten as a threshold score, the PHQ-9 was found to have a sensitivity of 88% and a specificity of 89% for Major Depressive Disorder. The Perceived Stress Scale questionnaire measures the extent to which subjects consider the sample situations to be challenging.[24] A total score of 12 (males), 13.7 (females) in the age range 18-29 is considered normal.

ANALYSIS

Statistical analysis consisted of descriptive statistics, MANOVA, ANCOVA, and paired t-tests. Significance level was set at $p<0.05$.

Results

DESCRIPTIVE STATISTICS – DEMOGRAPHICS

There were 58 students who signed the consent form, 21 males and 37 females ranging from 21 to 34 years of age. The mean age was 23.9 years (SD 2.3). There was no difference in age between males (25.1) and females (23.9). Four students were married, five were living with their partners, and 49 were not living with any partner. Sixty-two percent of students identified as Caucasian, 3% identified as African American, 28% identified as Asian, 2% identified as biracial, and 5% did not disclose their race. All students were first- or second-year medical students.

BASELINE COMPARISON BETWEEN INTERVENTION AND CONTROL GROUPS

First, the intervention and control groups were compared on the dependent variables measured at baseline using MANOVA. There were no significant differences between the groups in any measure of distress or measure of nutrition. There was a significant difference in minutes of physical activity. Controls had more minutes of activity than the intervention group ($p<007$). (Table 1). Therefore, baseline values were used as covariates in the analyses comparing the control and intervention groups.

Table 1. Comparison of baseline using MANOVA and post intervention values using ANCOVA; intervention (n=30) vs. controls (n=21) Values are mean (SD)

	Baseline intervention	Baseline control	p-value	Intervention Group	Control-no intervention	p-value
DISTRESS						
Perceived Stress Scale	16.8 (5.6)	16.8 (6.3)	.99	**13.9 (7.0)***	**18.2 (6.2)***	**.02**
GAD-7	8.03 (4.6)	5.7 (3.6)	.07	**5.9 (4.3)***	**7.1 (3.7)***	**.04**
PHQ-9	6.2 (3.3)	4.6(3.3)	.11	4.9 (3.4)	4.4 (4.1)	.81
PHYSICAL ACTIVITY						
Minutes of Physical Activity	**100.9 (111)***	**207.7 (150.3)***	.008	126.6 (124.9)	210 (173.3)	.09
Steps	6317 (3646)	5156 (3060)	.27	61388 (2731)	5389 (3159)	.61
NUTRITION						
Fruits/Veg	13.2 (3.2)	14.2 (7.3)	.51	14.5 (4.6)	16.9 (7.1)	.16
Dietary Fats	19.7 (8.0)	17.4 (7.5)	.33	**13.5 (6.5)***	**15.8 (7.7)***	**.03**

ANCOVA ANALYSIS: INTERVENTION VS. CONTROL (TABLE 1)

An ANCOVA test was performed to identify differences between post intervention and post control values using the baseline value as a covariate for each variable. There were significant differences between the intervention group vs. the control group in perceived stress (p=.018) and anxiety (p=.04). Those values were significantly lower in the intervention group than the control group. There was also a significant difference in dietary fat (p=.026). Dietary fat was significantly lower in the intervention group.

BASELINE, POST PROGRAM COMPARISON OF THE DEPENDENT VARIABLES IN ALL WHO HAD THE INTERVENTION. (Table 2)

Table 2. Comparison of baseline and post intervention values in all that received the intervention (N=51). Values are mean (SD)

	Baseline	**Post Intervention**	**P value**
DISTRESS			
Perceived Stress Screener	**16.8 (5.6)**	**13.9 (6.2)**	**0.004**
GAD-7	**7.2 (4.2)**	**5.4 (4.3)**	**0.004**
PHQ-9	**5.5 (3.3)**	**4.5 (3.6)**	**0.02**
PHYSICAL ACTIVITY			
Average steps per day	5971.8 (2948)	6279.0 (2920)	0.42
Minutes of activity/wk	**143.6(131.8)**	**175.8 (149.6)**	**0.03**
NUTRITION			
Dietary Fat Screener	**18.6 (7.9)**	**14.5 (6.6)**	**0.001**
Fruit-Vegetable Screener	**13.3 (5.1)**	**15.4 (5.3)**	**0.006**

A paired samples T-test was performed on data obtained from all those who received the intervention (51 individuals). There were significant improvements in perceived stress (p=.004), anxiety (p=.004) and mood (p=.02). In the nutrition category, there was an increase in fruits/vegetables intake (p=.006) and a decrease in dietary fat (p=.001) post intervention compared to baseline. There was also an increase in the number of minutes of physical activity (p=.03), but no significant increase in the number of steps per day.

Result from the stress management, nutrition, and physical activity subgroups. (Table 3)

A paired samples t-test was performed for the group who received the stress management intervention (21 individuals). A decrease in each measure of distress was observed. Perceived stress (p=.03), anxiety score(p=.01), and mood score (p=.01) were lower at post intervention compared to baseline.

A paired samples t-test was performed on the group who received the nutrition intervention (14 individuals). An increase in fruits/vegetables intake (p=.001) and a decrease in dietary fat intake (p=.001) were observed and shown to be significant.

Table 3. Comparison of baseline and post intervention values in focus groups. Values are mean (SD)

	Baseline	Post Intervention	p-value
Stress management Group			
Perceived Stress Screener	**17.71 (5.5)**	**14.38 (6.0)**	**.03**
GAD-7	**9.19 (4.8)**	**6.48 (5.1)**	**.01**
PHQ-9	**6.57 (3.5)**	**4.86 (4.0)**	**.01**
Physical Activity Group			
Average steps per day	4637.5 (2174.0)	4965.43 (2191.9)	.22
Minutes of activity/wk	123.2. (149.9)	158.67 (126.1)	.10
Nutrition Group			
Dietary Fat Screener	**26.18 (5.8)**	**17.09 (7.0)**	**.001**
Fruit-Vegetable Screener	**12.54 (5.1)**	**16.54 (5.0)**	**.001**

A paired samples t-test was performed on the group who received a physical activity intervention (16 individuals). Increases in minutes of physical activity and average steps per day were observed, but they were not significant.

THREE MONTH FOLLOW UP

Comparisons were made between immediate post intervention and 3 months post intervention. Paired samples t-test showed no difference in dietary fat between post intervention and follow-up. An increase in fruits/vegetables was observed and shown to be significant ($p<.05$). There were no differences in the measures of distress or the measure of physical activity from post intervention to follow up.

SATISFACTION WITH THE ELECTIVE

Based on 50 responses, students rated the usefulness of the elective as 3.4 (on a 4 point scale; 4 = very useful). No student indicated that the elective was "not useful". In response to the question: would you recommend this elective to another student, the average of 50 responses was 2.81 on a 3 point scale (3= yes, 2-maybe, 1 = no).

Discussion

The current study builds upon and strengthens confidence in the findings from earlier studies in this area.[14-15] The inclusion of a control group in the study design confirms the effectiveness of the LM intervention in impacting health behaviors of medical students. It was found that experimental subjects as a group showed improvement in diet, distress, and anxiety measures compared to controls. Although the focus groups only concentrated on one element of LM in each group, there was improvement in the intervention subjects in many focus areas. This may reflect a broader interest in improving health behaviors beyond the specific area addressed in their focus group meetings.

Both the stress management and nutrition groups showed significant improvement in their respective focus areas. This was not true in the activity group. An examination of the data suggests that the small number of subjects in the activity group, as well as the large range of their activity scores (minutes and steps), may have contributed to the lack of significant findings. Considering the consolidated groups, post intervention reviewed a significant increase in minutes of activity, substantiating the need for larger samples. The medical students were successful at making behavior changes. It is also important to note that gains made during the intervention period were still observable after 3 months. In fact, the consumption of fruits and vegetables even increased beyond immediate post intervention scores. This finding suggests that there was no return to baseline values with no reminders, and students continued to utilize and grow the lifestyle behaviors they learned and implemented during the intervention.

Unlike most programs in LM for medical students which have focused on diet and/or exercise, the current study included a stress management focus group. This intervention's effectiveness in helping students reduce perceived stress and anxiety suggests it should be included in future LM programs. Overall, this study not only illustrates a design for future LM programs, it also verifies its attraction to medical students, its feasibility in a medical student curriculum and provides evidence of student success in modifying their own lifestyle.

Study weaknesses included the relatively small number of subjects and the limited geographic areas from which they were drawn. Although the number of dropouts from the program was not large, their presence does represent a limitation in the study. It was hoped and anticipated that besides affecting the students' personal health behaviors, the program would impact their practice as clinicians. However, the current study did not

include any direct or indirect measures of this desired outcome.

Future research should replicate the current study in larger samples which should be drawn from multiple, geographically diverse sites. Educators in other professions are developing resiliency intervention programs.[25-26] Drawing on their findings may strengthen programs designed for medical students. Varying the number of intervention hours in future studies would help to determine the optimal length of the program. Including measures to study the impact of the program on clinical practice is recommended. Evaluation of student performance with standardized patients may be helpful in this regard.[15] Altering the activity outcome measures to reveal possible effects of the intervention is also encouraged.

Conclusions

Medical students are interested in learning about Lifestyle Medicine. Education about LM concepts and techniques can be added to the medical school curriculum as an elective. It is important to involve clinical faculty who are using LM in their care of patients in the educational offering. Participation in a personal change project can be helpful to students to understand the process of setting specific goals and implementing a plan for change. Data collection reinforces for students their lifestyle challenges and offers them the opportunity to see positive results. Case presentations allow preclinical students to begin to appreciate the importance of LM in clinical practice.

Conflicts of Interest Statement

The authors have no conflicts of interest to declare.

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